DOCUMENT RESUME

ED 219 842 EA 014 687

AUTHOR Conners, Dennis A.
TITLE The School's Macro and Micro Physical Environment: A Link to Understanding Stress.
PUB DATE Jan 81
NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (New York, NY, March 19-23, 1982).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Classroom Design; Crowding; *Educational Environment; *Educational Facilities Design; Elementary Secondary Education; *Environmental Influences; Higher Education; Noise (Sound); Personal Space; Privacy; School Buildings; School Space; *Stress Variables

ABSTRACT

Defining stress as a "misfit" between individual needs and environmental attributes, this paper reviews research on areas where the designed environment, on both a schoolwide and a classroom level, interacts with the educational process. These interactions are considered from the perspective of stresses imposed on both teachers and students. The macro-environment of the school is examined in terms of its effect on the social interaction, wayfinding, and spatial orientation of users. The micro-environmental variables occurring in classrooms discussed include seating position, classroom design, density (number of students per unit of space), privacy, and noise, and their stress-producing impact on the classroom unit. (MLF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED219842

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Dennis A. Conners

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

THE SCHOOL'S MACRO AND MICRO PHYSICAL ENVIRONMENT: A LINK TO UNDERSTANDING STRESS

DENNIS A. CONNERS

ASSISTANT PROFESSOR OF EDUCATIONAL ADMINISTRATION

COLLEGE OF EDUCATION

CLEVELAND HALL

WASHINGTON STATE UNIVERSITY

PULLMAN, WA 99164

January 1981

PAPER PRESENTED TO THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

ANNUAL MEETING, NEW YORK CITY, MARCH 1982

EA 014 687

Winston Churchill once said that we shape our buildings and then they shape us. If this is true, and it is the author's belief that it is, then there is no designed environment that needs immediate attention more than does the school facility.

Education has gradually moved from settings once held in the natural environment to buildings which have been specially designed for the purpose. Gone are the days when youngsters learned their lessons working in the fields with their fathers, or in the kitchen with their mothers. The days of Greek youth receiving instruction informally in streets and gardens of Athens are gone. In the past, apprentices learned trades in the homes of master craftsmen and activities were not restricted to a foreign or sterile environment. Mass education, brought on by the Industrial Revolution, brought about buildings erected specifically for the purpose of education. Urban students attended buildings which resembled the factories that were springing up around the neighborhood. The rural student was predominently educated in a large one-room schoolhouse.

Today, most all formal education takes place in the artificial environment of the school and classroom. The artificiality of these teaching centers is inconspicious and widely accepted as standard. The designed environment's function is to provide a climate which is primarily conducive to both teaching and learning. The assumption by those who design schools has been that as long as certain minimum standards for size, acoustics, lighting and heating were met productive environs existed and the teaching-learning process would proceed normally.

The built environment only intrudes on the consciousness when it causes particular pleasure, harm, discomfort, or stress. Increasing

numbers of educators and planners have begun to believe that other dimensions of the physical environment might have an effect on those involved in the educating process. There is growing evidence that the designed environment of schools may stress users of the facility both directly and indirectly. The purpose of this paper is to explore several areas where the designed environment, both on a school-wide and a classroom level, interacts with the educational process. The paper will consider these interactions from the perspective of stresses imposed on both teacher and student.

The Concept of Stress

It is important to provide a clear and unambiguous definition of stress because stress has been operationalized in a variety of ways. This inconsistency contributes to the wide diversity of results in the review of stress research. McGrath (1976) viewed stress as an environmental situation perceived as presenting a demand which threatens to exceed the person's capabilities and resources for meeting it. Baum, Singer, and Baum (1981) defined stress as a process in which environmental events or forces threaten an organism's existence and well being and the organism responds to the threat. Zimring (1981) wrote that stress results from the dynamic interactions of person and environment. He argued that stress arises from a misfit between individual needs and envrironmental attributes. For the purpose of this paper, the author will use Zimring's definition of stress.

The severity of stress and its long term consequences for the individual are affected by many issues. Whether or not the individual views the misfit as important, the chronic or serious nature of the misfit, and

strategies available to the individual for resolving the misfit are only a few such issues (see Baum, et. al., 1981). However, according to Zimring, characteristics of the individual and the design of the environment affect the regulation of fit between person and physical environment in two ways. First, an individual has a wide range of social, cognitive and behavioral goals: intimacy, separation, information, acquisition, task achievement, to name only a few. When a misfit is perceived -- when the individual feels a goal is being thwarted -- the individual adopts a coping strategy that is influenced by the qualities of the situation, by past experience, and by other influences.

Second, the overall design of the physical environment affects the fit between person and environment both directly and indirectly. The design of a particular environment may directly support or thwart a user's goal. For example, light levels, acoustic qualities, and temperature in a school or classroom may be appropriate or inappropriate for a given task; the arrangement of learning spaces, their separation and size may support or impede a user's goals. The design of the environment may also indirectly influence the person-environment fit by making desired social interactions easier or more difficult to achieve. For example, a clear delineation between group and individual space such as individual study carrels may support the need for privacy of students in a large library. The symbolism of the carrel tells other students: "This is my private space now."

There is an additional issue to be considered when examining the design environment and stress. The coping processes used to resolve stressful situations are affected by the design of the environment. Zimring reported that when faced with a misfit, an individual may adopt

one or both of two strategies: (a) changing his or her needs through intrapersonal means, or (b) changing the situation. The design of the environment particularly affects the second strategy. For example, if a student is trying to concentrate on an assignment which requires close attention, he or she may be distracted by the noise of other students. Should a sound-proofed study area be provided, the student may control the situation by moving there. However, if no choice is provided, an intrapersonal coping strategy may be adopted: the student may abandon the goal of completing the assignment.

Obviously, the social system limits the role of physical design in person-environment fit. While the opportunity for choice may be provided by the physical design, specific norms and practices preclude taking advantage of the opportunity. In the example cited above, the physical design for a quiet study area may be present, but the social system may demand that intrapersonal coping strategies be used (see Knight, Zimring, & Kent, 1977).

This paper will examine the pertinent research dealing with the schools' physical environment and its affect on stress. The first section considers the macro-environment of the school in terms of its affect on the social interaction, wayfinding, and spatial orientation of users. The second section discusses micro-environmental variables and their stress-producing impact on the classroom unit.

The Macro-environment

Social Interaction

One major way the designed environment influences levels of stress is by affecting the social interaction of the individual. Baum and Valins

(1977) have documented situations where design dysfunction has impacted with social goals to produce negative outcomes for users of the designed environment. Epstein (1981) argued that these negative outcomes, experienced by building users, can be seen as cases where the environmental design thwarted needs for intimate interaction, exercise of social networks, and a time and place for social interactions. When thwarting occurs, and when no efficient coping strategies are provided, pychological and social consequences may result, including anxiety, acting-out, and in some cases crime.

For those children and adults who inhabit schools, a portion of day-to-day social interaction is casual and informal involvement. This particularly applies to the teaching staff where rushed meals, short planning periods, and stolen moments between classes provide the only time in which personal contact with other adults is made and friendships maintained. It has become clear that environmental designs may stress users by making casual interactions difficult and personally costly. Bechtel (1977) suggested that informal contacts may be encouraged by what he termed activity nodes. These spaces allow business and recreational contact to be carried on in a low-keyed, casual manner. His study of Alaskan army bases found that residents' satisfaction with the base was at least partially dependent on the existence of an activity node. Bechtel proposed several principles distinquishing effective activity nodes: (a) that they are centrally located and equally accessible to all persons in the community; (b) that much traffic passes by them; and (c) that they have few visual boundaries, allowing people to see and be seen.

The design environment also creates boundaries between what may be conflicting activities. Stress may develop when mutually exclusive activities overlap thwarting important goals. The competing activities

create overload and block goals of students and teachers. Evans and Lovell (1979) evaluated the effects of a design modification in an open-plan, alternative high school which was experiencing problems with student distraction, class interruptions, high noise levels, and poor traffic flow patterns. Variable-height, sound-absorbant partitions were added to redirect traffic away from class areas and to define class boundaries. These modifications significantly reduced classroom interruptions and increased substantive, content questioning. In looking at employee reactions to an open-plan office, the results of a study by Oldham and Brass (1979) showed employee satisfaction and motivation decreased significantly after the move to an open office. Moreover, analysis suggested that changes in job characteristics, that accompanied the change in facilities, explained much of the decline in satisfaction and motivation. Wineman (1980) reported that office workers in open-plan offices were consistently dissatisfied with the lack of auditory privacy. They sensed they were being overheard and were concerned with confidentiality. These types of boundary control problems have seriously limited the growth of open-plan design in schools.

The design of the environment affects social interaction in two ways: (a) it can provide a setting for an appropriate level of interaction; and (b) it can make the modification of social interaction difficult, thereby affecting the real or perceived control people have in achieving a desired level of interaction. The designed environment can affect the individuals' perception of personal control. Baron and Rodin (1978) wrote that when an individual feels in control, he or she may be happier in general, may perform better, and may be less bothered by crowding and other stressors. The design of an environment may provide the opportunity for control by

providing a well-differentiated hierarchy of spaces that allows both choice over different spaces and control over interaction in a given space (Zimring, 1981).

If the environment makes control of interaction difficult there may be undesirable consequences. For example, the learning process demands that various conditions involving student-teacher interaction, access to materials, and appropriate time-on-task be met. Having these goals thwarted may be stressful for both student and teacher. If building environments are not to be stress-inducing, they must allow participants to change their level and type of interaction to suit their needs.

Wayfinding and Spatial Orientation

There is a second major way that the designed environment may influence stress. Evidence suggests that individuals make important self-assessments based on their performance in wayfinding and spatial orientation (Weisman, 1981). Wayfinding is described as the actual behaviors people employ in finding locations in the environment. Orientation is the ability to relate or know one's location to other features in the environment.

The research concerning wayfinding behavior is limited. However, a recent study by Weisman (1981) asked judges to rate the legibility of abstract floorplans of academic buildings. He found that these ratings were a good predictor of the building users' self-reported incidence of getting lost. This suggests that users become disoriented in buildings where overall circulation patterns are confusing and hard to visualize. In an evaluation of the Arts and Architectural building at the University of Illinois, Chicago Circle campus, it was asserted that the circulation pattern "...seriously upsets the orientation of everybody who uses the

building ... The first reaction among people who pride themselves on their space perception is 'indignation'" (Dixon, 1968, p. 35; cited in Zimring, 1981).

Weisman (1979) suggested that the particular behaviors people use to find their way in buildings is affected by four design elements: (a) perceptual access, which is the degree to which the user can actually see short range or long range destinations; (b) visual differentiation which is the visual distinctiveness and personal and community significance of design features; (c) signs; and (d) legibility. He found that users' self-reported wayfinding behavior was predicted by the overall architectural configuration of the facility and by one distinctive aspect of the architecture. A study in which researchers color coded an academic building found that users actually found their way more effectively, could point more accurately at landmarks, and could better recognize and recall building floorplans (Zimring, 1981).

While there has been little empirical research investigating the relationship of wayfinding and spatial orientation to stress, certain conclusions can be drawn from what has been reported. Poor wayfinding can lead to disorientation and thus to higher levels of anxiety. People lost in buildings have shown considerable anxiety. Being spatially oriented is a need for many people, and when this orientation is lost, they become panicky and anxious. Buildings which encourage effective wayfinding reduce anxiety and stress; buildings that inhibit effective wayfinding increase anxiety and stress.

The Micro-environment

Thus far, linkages have been examined between the overall designed environment and stress. It is necessary, for a complete treatment of

the subject, to investigate the affect of the classroom environment on stress. If the definition of stress outlined in the first section of this paper is applied -- that stress arises from a misfit between individual needs and environmental attributes -- then examination of such micro-environmental variables as seating position, classroom design, density, privacy, and noise may shed additional light on the facility's impact on users' stress.

Seating Position

Weinstein (1979) reported that the only physical variable which has been linked to differences in school achievement was seating location. However, in a review of the findings, the data appeared somewhat inconsistent. Adam and Biddle's (1970) work demonstrated that the "target" of teachers' communication was overwhelmingly located in the front and center portions of the classroom. This "action zone" phenomenon has been linked to the facilitation of achievement, positive atttitudes, and participation on the part of students.

Classroom Design and Arrangement

Howowitz and Otto (1973) addressed the question of the influence of design on achievement. They compared the scholastic achievement of college students in a traditional classroom and a specially designed "alternative learning facility," which contained a great deal of color, movable wall panels, a complex lighting system, and flexible comfortable seats. While no difference in learning could be shown, anecdotal information indicated a difference in classroom behavior. Attendance in the experimental room was better, students participated more, and there was

more informality and group cohesion. These findings support the notion that learning space design can substantially affect attitudes and non-achievement behaviors. Laboratory studies by Maslow and Mintz (1956) disclosed a relationship between an "ugly" environment and feelings of discontent, the desire to escape, and fatigue.

Kritchevsky and Prescott (1969) directed attention to the need for individuals engaged in classroom design to be aware of the environment's impact on behavior. They emphasized that teachers must carefully consider their behavioral goals for the students when arranging their rooms. Otherwise, "they may force behavior which acts against the achievement of desired goals...It becomes important then, in examining space, to be sure the content necessary to support the goal is present" (p. 15).

Finally, the question of a design's compatibility with the teacher's own needs and teaching style was examined when Feitler, Weiner, and Blumberg (1970) demonstrated a relationship between an individual's interpersonal needs and preference for classroom layout. They reported that education students with high control needs liked formations where the teacher was clearly in a position of control, while subjects with low control needs selected settings where the teacher's control position was less obvious.

Density and Crowding

As Weinstein (1979) so aptly wrote "Nowhere else [but in schools] are large groups of individuals packed so closely together for so many hours, yet expected to perform at peak efficiency on difficult learning tasks and to interact harmoniously." (p. 585) There is a difference between density and crowding. Density is a mathematical measure of the

number of people in a given space. Crowding refers to the perceived judgement of excessive density. So far, researchers concerned with the social and affective responses to high density have focused only on the beginning and end points of the educational system, namely, the nursery school and college. Weinstein (1979) reviewed a number of studies and found the evidence sufficient to suggest a number of undesirable reactions, such as dissatisfaction, nervousness, less social interaction, and increased aggressiveness were associated with density.

Privacy

Privacy is another multidimensional concept. Winstein (1979) suggested that privacy is made up six orientations: (a) the preference for non-involvement with neighbors; (b) seclusion; (c) solitude; (d) privacy with intimates; (e) anonymity; and (f) the reluctance for self-disclosure. The open-space schools appear to eliminate any possibility for privacy. However, according to Brunetti (1972) they may actually provide more opportunities for solitude and seclusion than traditional buildings. The researcher asked elementary school students in two open-space and one conventional school to indicate how often they were able to find an adequate place to study by themselves when they so desired. Over 50% of the students in open-space schools compared with 24% of the students in conventional schools reported that they could find an adequate place "most of the time." High school students in one open-space and two conventional buildings were asked to indicate how often they were unable to find a quiet place for individual study and a place where they could not be seen by others. Approximately 25% of the students in all three schools indicated that they were unable to screen out noise adequately.

However, 27% of the students in the open-space environment indicated that they were unable to be visually secluded compared to 34% and 40% in the conventional schools. From this investigation the conclusion can be drawn that open-space schools may provide many more alternatives for choice of personal study space, and thus seclusion and privacy, than do classrooms in conventional schools.

Noise

The reminder that "it's getting too noisy in here" is a message familiar to almost everyone who has ever stood in front of a grade school class. Weinstein (1977) reported that little research has been conducted in schools on the effects of realistic noise on student achievement. Those investigations which have been done can be classified into two categories: (a) studies of short-term exposure to moderate noise originating within the school; and (b) studies of long-term exposure to more severe noise from an external source such as an airport or highway.

The results of the short-term studies of internal noise have found no significant differences in student performance. However, as Weinstein points out, the noise conditions were not especially extreme. Cohen, Krantz, Evans, and Stokols (1980) found that children in the air corridor of the Los Angeles International Airport performed as well as their counterparts from quieter schools on tests of auditory discrimination, mathematics achievement, and reading achievement. While these findings contradict earlier studies, the children from the more noisy school did not perform as well on a puzzle task and manifested greater distractibility with increased years of exposure to the noise. These children were more likely to demonstrate a lack of persistence on the puzzle task

and had significantly higher blood pressure. Clearly, the imposition of noise as a stressor has implications for the school's designed environment.

Implications

The relationship between stress and the school's physical environment has several implications not only for the educational designer, but also for the administrator and teacher. Schools need to provide places which will enhance goals for interaction, for participation in social networks, and for control over the time and place for social interactions. Indeed, many newer facilities have incorporated outside benches and tables, student lounges, and other appropriately convenient gathering spots for social interaction. These types of environmental designs increase the predictability of interactions making them easier to control, hence reducing stress. Increasing room volume and providing partitions to some open-space learning areas are likely to increase the predictability of users' interactions and feelings of both choice and control.

Schools also need to be designed in such a manner that problems with wayfinding will be reduced. Overall regularity of design appears to be an effective way of dealing with this, although, regularity without distinctive landmarks can be stress-inducing. Schools should be planned using landmarks which are visible and distinctive, perhaps making use of colors and symbols.

While the findings are mixed on whether the physical environment of the classroom has a direct affect on achievement, there is considerable evidence to suggest that it does affect nonachievement behaviors and attitudes. Relatively minor design modifications introduced into already functioning classrooms have been shown to produce changes in students'

spatial behavior, increased interaction with materials, and decreased interruptions. The congruence between an architecturally designed environment which fits the needs of students, teachers, administrators, citizens, and the educational program is absolutely vital.

References

Adams, R. S., Biddle, B. J. Realities of teaching : Explorations with video tape. New York: Holt, Rinehart, & Winston, 1970.

Baron, R., Rodin, J. Personal control as a mediator of crowding. In A. Baum, J. E. Singer, and S. Valins (Eds.), Advances in environmental psychology, Volume 1 : The urban environment. Hillsdale, NJ: Erlbaum, 1978.

Baum, A., Singer, J. E., and Baum, C. S. Stress and the environment. Journal of Social Issues, 1981, 37(1), 4-35.

Baum, A., Valins S., Architecture and social behavior: Psychological studies of social density. Hillsdale, NJ: Erlbaum, 1977.

Bechtel, R. Enclosing behavior: Stroudsburg, PA: Dowden, Hutchinson & Ross, 1977.

Brunetti, F. A. Noise, distraction and privacy in conventional and open school environments. Proceedings of the EDRA conference. Los Angeles: University of California, 1972.

Cohen, S., Krantz, D., Evans, G. W., and Stokols, D. Community noise and children: Cognitive, motivational,and psychological effects. In J. Tobias (Ed.), The proceedings of the third international congress on noise as a public health problem. Washington, D. C.: American Speach and Hearing Association, 1980.

Dixon, J. M. Campus city revisited. Architectural Forum, 1968, 129, 28-43.

Epstein, Y. Crowding stress and human behavior. Journal of Social Issues. 1981, 37(1), 126-144.

Evans, G. W., Lovell, B. Design modifications in an open-plan school. Journal of Educational Psychology., 1979, 71, 41-49.

Feitler, F. C., Weiner, W., and Blumberg, A. The relationships between interpersonal relations orientations and preferred classroom physical settings. Paper presented at the annual meeting of the American Educational Research Association, Minneapolis, 1970. (ERIC Document Reproduction Service No. ED 030 173).

Horowitz, P., Otto, D. The teaching effectiveness of an alternative teaching facility. Alberta, Canada: University of Alberta, 1973 (ERIC Document Reproduction Service No. ED 083 242).

Knight, R. C., Zimring, C. M., and Kent, M. J. Normalization as a social-physical system. In M. J. Bednar (Ed.), Barrier-free environments. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1977.

Kritchevsky, S., Prescott, E. Planning environments for young children: Physical space. Washington, D. C.: National Association for the Education of young children, 1969.

Maslow, A. H., Mintz, N. L. The effects of esthetic surroundings. Journal of Psychology, 1956, 41, 247-254.

McGrath, J. E. Social and psychological factors in stress. New York: Holt, Rinehart & Winston, 1970.

Oldham, G. R., Brass, D. J. Employee reactions to an open-plan office: A naturally occurring quasi-experiment. Administrative Science Quarterly, 1979, 24, 267-284.

Weinstein, C. S. The physical environment of the school. Review of Educational Research, 1979, 49(4), 577-610.

Weisman, G. A. Architectural legibility. Environment and Behavior, 1981, 13(2), 184-204.

Wineman, J. D. The design of office environments. Paper presented at the Environmental Design Research Association Conference, Charleston, SC, March, 1980.

Zimring, C. M. Stress and the designed environment. Journal of Social Issues, 1981, 37(1), 145-171.